PS Plans for 1008

Bob Lambiase

sPHENIX Magnet Review

December 16, 2014

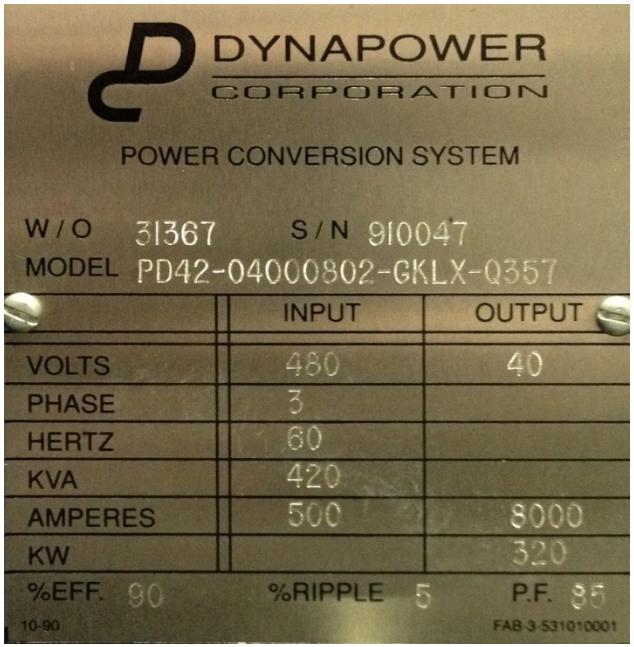
Overview

- What we have: We have a system that had functioned, but has not been used for several years. It has been stated that all the elements we have were working at the time of shut down.
  - Power Supply – We have two identical power supplies. Only one is needed and only one will be upgraded in our current plan.
  - Quench Detection Circuitry – This has been described as a 10 year old design 15 years ago. Isolation was provided by rechargeable batteries.
  - Energy Dump Switch – We have the mechanical switch used at SLAC. This has functioned for actual quenches.
  - Energy Dump Resistor
- What we want:
  - The individual elements will be upgraded to improve reliability and compatibility with BNL's control system.
  - The equipment will be installed and tested in 1008, and will become operational equipment.

The Power Supply – What We Have

The power supply is SCR controlled and rated 8.0 kA at 40 V, and was used at 4.6 kA at 20 V.

State control and interlocks are implemented with a SLC 5/3 PLC. The present source code is said to exist, but has not yet been obtained.



The Power Supply Upgrade Path

- Establish a baseline: The equipment will be run prior to modification to ensure operation and performance.

- Reliability enhancements: Electrolytic capacitors in the power circuit will be replaced. It addition, it is standard practice to replace the firing card when upgrading old SCR supplies.

- PLC Replacement: The PLC will be replaced with a model which is currently standard in our department. It will use the software most commonly used by our programmers. The existing PLC software will be examined, but most of the software will need to be re-written.

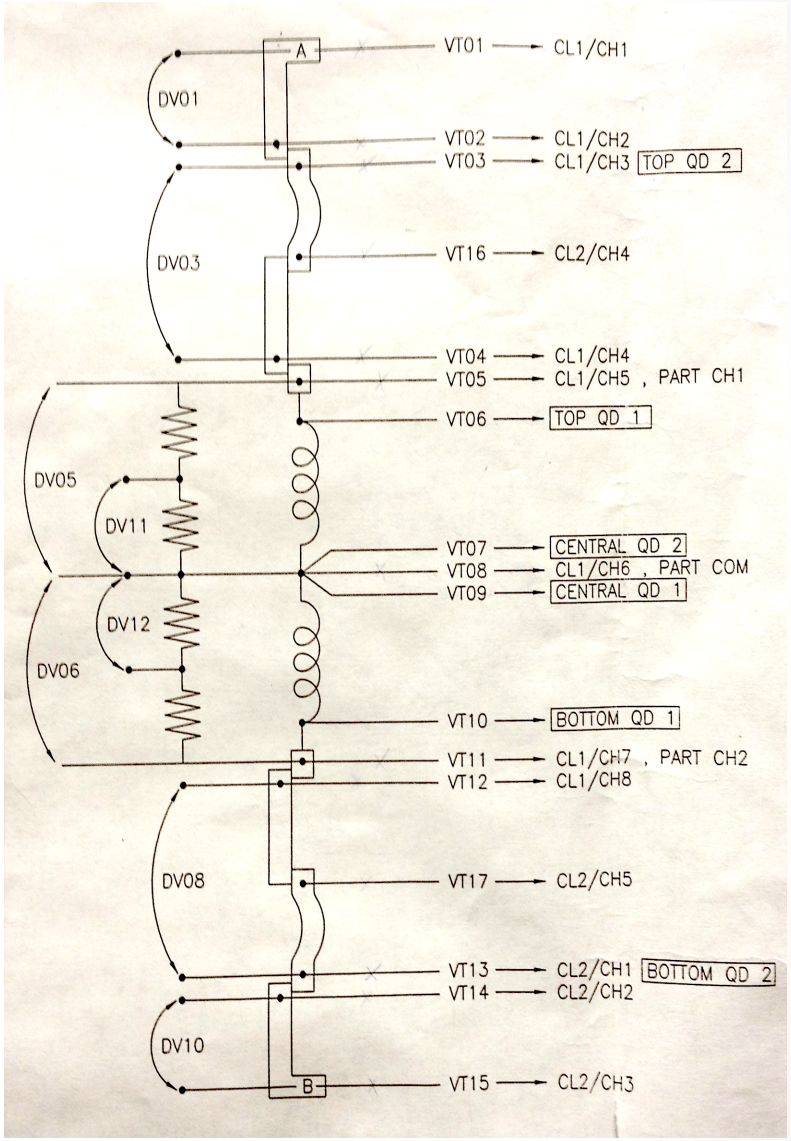
- Control Interface: To make the system compatible with the BNL control system, a standard BNL PSI will be integrated into the power supply.

Quench Detection

The quench detection system is based on a nearly center tapped magnet. The tap is between the inner and outer winding, so the inductance of the two halves are not equal.

SLAC engineers said there was a considerable effort to balance the signals, but that was with a old and less sophisticated system than we'll build.

The existing quench detection system will be scrapped and replaced by modern NI based equipment.



Energy Switch and Dump Resistor

Energy Switch

A DC contactor was successfully used at SLAC. SLAC engineers had replaced the contacts on the switch once, but it was scheduled maintenance, not due to failure.

With a little care, this should be completely usable in our new system. We'll test the switch and replace the contacts before operation.

Dump Resistor

This dump resistor is physically very large, but is designed to handle the energy stored in the magnet. We will also use this in the new system. If temperature monitoring is not installed or not functioning, this will be added.

Installation and Testing

The power supply upgrade, quench detection development, and the energy switch refurbishing will be done off-line. Following that, considerable effort is required for installation.

- Physical placement of the power supply, quench detection rack, energy dump resistor and switch.
- AC power cabling supply and support equipment
- DC output cables or bus to handle the 4.6 kA output current
- Instrumentation cabling for quench detection and thermal monitoring of the dump resistor
- Interlock cables and control fibers for the PSI

After integration, the unit is tested as a system.